

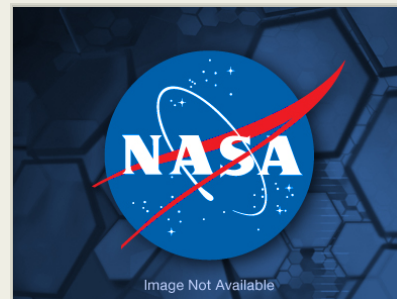
# An Instrument Concept for Combined Observations of GNSS and Astronomical Sources Through a Standard Signal Path for Geodetic Applications

Completed Technology Project (2017 - 2018)



## Project Introduction

The stability of the terrestrial reference frame is critical for future scientific needs and both Global Navigation Satellite Systems (GNSS) and Very Long Baseline Interferometry (VLBI) instruments are crucial for defining the terrestrial reference frame. Yet currently, VLBI and GNSS instrumentation operate independently, with each instrument subject to unique biases and calibration requirements. To relate these measurements requires a physical measurement of the separation vector between the phase center of the VLBI dish and the phase center of the GNSS antenna, or some proxy. We ask the following question: "Is it possible to develop an instrument concept in which GNSS signals and astronomical source signals are sampled via the same signal chain, effectively ensuring that both measurements are made from the same antenna phase center, when processed in conjunction with measurements from a VLBI-like antenna?" In our vision a calibrated wide-bandwidth instrument that is capable of capturing GNSS and VLBI signals of interest simultaneously, allows us to have both signals seen through a combined and unified instrument. This tight coupling of these two measurements eliminates the need for additional physical ties between instruments. Ultimately, we expect this work to contribute to improvements in the accuracy and stability of geodetic reference frames. A wide variety of earth observations, particularly those measuring earth features like sea level from airborne and space-borne platforms will benefit from these improvements. As a first step towards this larger vision, we propose for this initial incubator effort a UT1 measurement, which directly relates to a wide variety of mass transport phenomena in the earth system. As a first step towards this larger vision, we intend an instrument concept development effort which would investigate the development of a combined instrument while focusing on a straightforward goal of geodetic interest. We intend to focus on the measurement of UT1 using a VLBI dish and two low gain antennas. UT1, which is UT0 corrected for polar wander, is a routinely observed quantity so truth data will be available. Our plan is to demonstrate our concept using a VLBI dish, along with two small-aperture GNSS-like antennas together. We will utilize a High Rate Tracking Receiver (HRTR) we have developed as a data collection instrument. We have aligned our plan with scheduled installation of a NASA Space Geodesy Project VLBI antenna at McDonald Observatory in late 2017. This would serve as the source of our VLBI measurements, but a substantial fraction of the work will be done using a 3-m dish antenna at Applied Research Laboratories, The University of Texas at Austin (ARL:UT.) This effort is envisioned as an 18-month effort, beginning 1 January 2017 and completing 30 June 2018, with a go/no go decision point at month 12 on whether to perform the full tests with a VLBI antenna. In the first 12 months, we will primarily focus on the high-level processing architecture, explicitly defining how UT1 will be computed from measurements, as well as implementation of this architecture, and initial tests using a 3m dish and an existing HRTR available at ARL:UT. This effort will begin with a TRL level of 2, and the exit TRL level will be 3.



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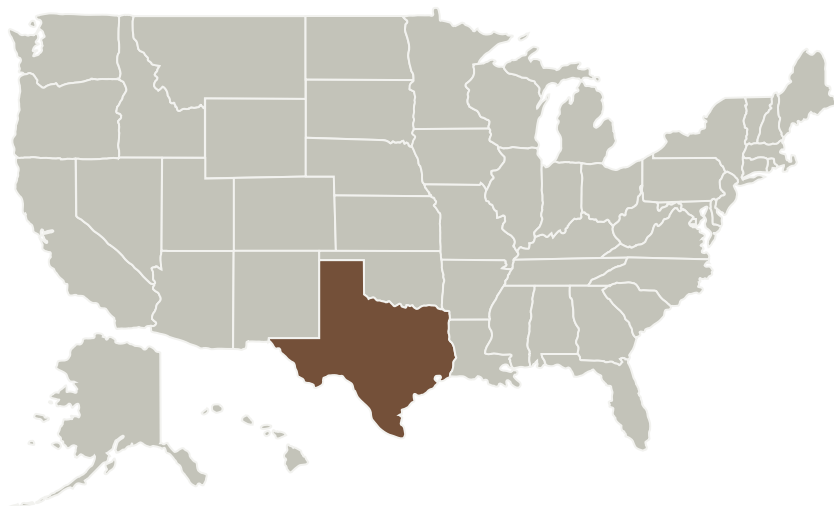
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
The University of Texas at Austin	Lead Organization	Academia	Austin, Texas

### Primary U.S. Work Locations

Texas

## Organizational Responsibility

### Responsible Mission Directorate:

Science Mission Directorate (SMD)

### Lead Organization:

The University of Texas at Austin

### Responsible Program:

Instrument Incubator

## Project Management

### Program Director:

Pamela S Millar

### Program Manager:

Parminder S Ghuman

### Principal Investigator:

David C Munton

### Co-Investigators:

Courtney Frazier  
Johnathan York

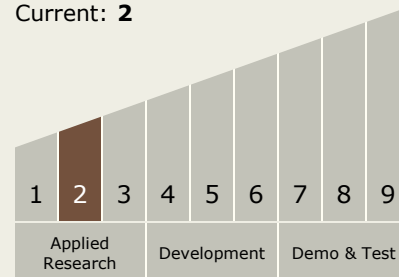
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## Technology Maturity (TRL)

Start: 2  
Current: 2



## Technology Areas

### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
    - └ TX08.1.1 Detectors and Focal Planes

## Target Destination

Earth